Information for Parents about
Urinary Incontinence

Urinary incontinence (diurnal or daytime and nocturnal or nighttime) is a common and often confusing problem among children. Most children are out of diapers and able to urinate in the toilet during the daytime by 3 ½ years of age. Nighttime urine control is usually achieved later, often after 4 or 5 years of age. Daytime incontinence causes frustration for children, their parents and their teachers at school. Enrollment in preschool frequently requires predictable daytime urinary continence. A variety of conditions can cause urinary incontinence. Therefore, it is important to determine the specific cause or combination of causes of incontinence so that the proper treatment can begin. Treatment is directed toward protection of normal urinary tract function and establishment of an effective voiding pattern with predictable dryness.

Normal urinary tract function

In the normal urinary tract, two kidneys filter the blood to produce urine which then drains through a funnel system within the kidney called the renal (kidney) calyces and pelvis. Urine then travels from the renal pelvis through the ureter (a muscular conduit) to the urinary bladder. A one-way flap valve at the bottom of the ureter (ureterovesical junction) allows urine to pass into the bladder freely, but prevents any urine from going backwards up the ureter to the kidney. Urine is pushed through the ureterovesical junction at intervals by muscular contraction of the ureter (peristalsis). The bladder stores urine at low pressures until it is eliminated completely through the urethra outside the body with periodic voiding.

The internal sphincter muscle wraps around the urethra at the bladder neck, and provides a resting amount of muscle contraction (tone) that automatically relaxes during voiding. Neurologic problems of the spinal cord can disrupt normal function, but there is no volitional (voluntary) control associated with the internal sphincter. The external sphincter, which is positioned slightly lower down the urethra, is the muscle complex that can be actively contracted to prevent urinary leakage until appropriate voiding can occur. External sphincter muscle activity can also be abnormal (increased or decreased) with spinal cord abnormalities, but it can also be increased markedly in some children with a dysfunctional voiding pattern (waiting until beyond the last minute to urinate). Extreme pressures generated by this holding behavior dilate the urethra to form the “spinning-top” urethral deformity, which produces turbulent and retrograde urine flow with voiding. Increased pressure, inefficient voiding of urine and vaginal pooling all contribute to the risk for urinary infection.

The detrusor muscle, which wraps around the body of the bladder, can continue to relax as the bladder fills with urine, but then will generate increasingly strong contractions at bladder capacity until bladder emptying is completed. Bladder emptying can be postponed either by inhibition of bladder contractions by neurologic control messages from the brain or by enhancing sphincter contraction. Just before voiding begins, the brain directs the sphincter muscle to relax, and then causes the detrusor muscle to contract.

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Both the external and internal sphincter muscles fully relax just before the detrusor muscle contracts to allow unimpeded, efficient and low-pressure voiding of urine. This mechanism is similar to when electronic doors at a store open fully before a group of customers enter or leave. The doors open before the first customer enters, and they remain open fully until the last customer passes through.

Bladder Capacity
The bladder slowly fills with urine until a threshold pressure (not volume) is reached. Intermittent bladder contractions then start to occur. These contractions are minimal at first and then become much stronger as the bladder continues to fill. The threshold for bladder contractions occurs at a range of bladder volumes (functional bladder capacity) depending upon multiple factors, including bladder wall thickening associated with a dysfunctional voiding pattern (limited bladder elasticity), over-distension of the sigmoid colon and rectum (increased pelvic pressure and impairment of efficient bladder emptying) and urinary infection (increased bladder irritability). Predictable urinary continence can be achieved if these factors are optimized, promoting a larger functional bladder capacity.

Effective Voiding Pattern
A normal bladder can slowly fill to hold at least four hours worth of urine at a time. Clearly, daytime dryness should develop before nighttime continence since a larger functional bladder capacity is required in order to remain dry for at least 8 hours of sleep. During the daytime, a scheduled voiding pattern every 2 to 3 hours is useful to prevent urinary accidents. Bowel emptying every morning may also eliminate symptoms of urinary urgency and frequency during the day.

Measures that promote nighttime continence include limitation of fluid intake for two hours before bedtime, and efficient bladder and bowel emptying prior to sleep. Increased urine production at night occurs with excessive fluid intake prior to bedtime. Renal blood flow also increases (by 20%) while recumbent, so urine is produced more rapidly at night. Some individuals may also lack the ability to effectively concentrate their urine at night, causing them to produce even more urine volume when sleeping. Bladder maturation allows more urine volume to accumulate before the bladder contraction threshold is reached. Bladder capacity at night can be decreased if the bladder and bowel are not efficiently emptied prior to bedtime.

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Improving functional bladder capacity is especially important in children that are extremely sound sleepers at night.

**Causes of Urinary Incontinence**
- Incomplete bladder emptying
- Urinary infection (inflammation)
- Urethral stricture
- Posterior urethral valves
- Neuropathic bladder dysfunction
  - Spinal cord tethering
  - Caudal regression syndrome
  - Myelomeningocele
- Bladder stone or polyp
- Ectopic ureteral anomaly
- Renal insufficiency with hypothenuria
- Dysfunctional elimination (constipation)

**Evaluation of Incontinence**
To understand the causes of urinary incontinence, it will be useful to measure your child’s bladder function. A *voiding diary* is simply a record of their voiding pattern, including frequency of urination and typical volumes of urine passed with each effort (use a hat urinal or plastic measuring cup). Monitoring the bowel evacuation pattern is also critical to understand bladder function because pressure from bowel distension is directly transmitted to the bladder.

**Urinary flow-rate analysis** (uroflow test), which is used to measure how fast the urine is passed through the urethra, provides best results when the bladder is full. Your child will urinate into a special commode that records urine collected over time. The volume of urine passed and the flow curve pattern (continuous or intermittent, forceful or prolonged) indicate the strength of bladder contraction. If the rate of drainage is slow or if the urine flow is intermittent, dyssynergy of the sphincter and detrusor muscles may be present. A prolonged flow pattern suggests either urethral stricture or significant constipation.

**Pelvic ultrasonography** can then be used to determine the amount of residual urine present after voiding, and also indicates bladder wall thickness (normally 2-4 mm) and the degree of colonic and rectal distension present.

**Renal ultrasonography** is useful to identify hydronephrosis that may be associated with either a duplex or ectopic ureteral anomaly. Measuring renal size is also helpful to evaluate for normal symmetric and healthy-appearing kidney parenchyma.

**Voiding cystourethrography** (VCUG) is used to assess for bladder trabeculation, bladder neck dysfunction, urethral stricture and vesicoureteral reflux. A urethral catheter is passed into the bladder through the urethra (generally under sedation in older children) and then the bladder is filled to capacity. Fluoroscopic imaging of the bladder and urethra during voiding indicate also indicate the efficiency of voiding and bladder emptying.

**Videourodynamic evaluation** may be necessary in certain patients with high-grade vesicoureteral reflux or spinal cord abnormalities.

**Bladder Capacity Example**
A 40-pound 4 year old creates approximately 20 ml of urine per hour. Their predicted bladder capacity is estimated at 180 ml (6 ounces). Under ideal circumstances, bladder capacity is greater than nocturnal urine production, and continence until morning is possible.

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Treatment of Incontinence

Some children respond to the overwhelming stress of their urinary incontinence by ignoring it. This can be frustrating for parents, and many parents interpret this as a form of deceit. It is probably more helpful to the child for a parent to recognize this response as denial, a common emotional defense mechanism. Concentrating on treatment of the incontinence rather than trying to teach the child to be honest about incontinence will ultimately be more helpful.

Diurnal (Daytime) Enuresis: with urinary urgency and frequency

- Scheduled voiding pattern every two hours while awake
- **Ditropan** (oxybutynin) therapy (liquid or tablet) twice daily
  - increases functional bladder capacity
  - especially if bladder wall thickening or trabeculation is present
- Effective bowel management
- Biofeedback training useful for detrusor-sphincter dyssynergy
- Endoscopic injection of Botox into detrusor muscle can be considered for treatment of hyperreflexia noted on videourodynamic evaluation

Nocturnal (Nighttime) Enuresis

- Limit oral fluid intake after dinner
- **DDAVP** therapy (nasal spray or tablet) one hour before bedtime
  - decreases urine production at night (normalizes after 4-6 hours)
- **Ditropan** (oxybutynin) therapy (liquid or tablet) one hour before bedtime
  - increases functional bladder capacity
- **Tofranil** (imipramine) therapy (tablet) may be helpful in teenage patients
  - increases functional bladder capacity
  - promotes effective “awakening response” to a distended bladder sensation
- Effective bowel management

**Effective bowel management**

Miralax or Benefiber in juice every morning (2-3 tsp)

* promotes timely and successful elimination with toilet-sitting attempts
* repeat dose at night if no bowel movement produced that day

Toilet-sitting for bowel emptying both before school and before bedtime

Monitor bowel pattern success with elimination calendar

* symptoms and success recorded by your child